

Town of Bedford, New York Greenhouse Gas Emissions Analysis

2004 Community Emissions Inventory & 2004 Government Operations Emissions Inventory

March 12, 2009

Updated on 6/8/09 to reflect change in fuel oil data

bedford twenty by **2020**



Credits and Acknowledgements

Town of Bedford:

Lee V.A. Roberts, Supervisor
Christopher Burdick, Town Councilman
Peter Chryssos, Town Councilman, Deputy Supervisor
Francis Corcoran, Town Councilman
David Gabrielson, Town Councilman

Bedford Energy Advisory Panel Members:

William Abranowicz
Shirley Bianco
Janet Harkham
Neal Hundt
Mary Beth Kass, Chair
Daniel Martin
Simon Skolnik
Mark Theilking
Dr. Stuart Weitzman

Other Town of Bedford Contributors:

Gail Amyot, Planning Department
Lisbeth Fumagalli, Town Clerk
Joan Gallagher, Director of Personnel
William Heidepriem, Superintendent, Recreation and Parks Department
Kim Kowalski, Administrative Assistant to the Supervisor and Town Clerk
Rick Megna, Building Inspector
Chris Menzel, Chief of Police
Jeffrey Osterman, Director of Planning
Thomas Polzella, Assessor
Joel H. Sachs, Esq., Keane & Beane, P.C.
Kevin Winn, Commissioner, Department of Public Works

Bedford Twenty by 2020 logo designed by Carol Bouyoucous

ICLEI – Local Governments for Sustainability

Missy Stults, Senior Program Officer, Northeast Regional Capacity Center

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Table of Contents

1	Introduction.....	
1.1	Climate Change Background	1
1.2	The Communities for Climate Protection Campaign	2
2	Greenhouse Gas Emissions Inventory.....	2
2.1	Methodology and Model.....	2
2.1.1	<i>CACP Software</i>	3
2.2.2	<i>Creating the Inventory</i>	3
2.2	Inventory Results.....	4
2.2.1	<i>Community Emissions Inventory</i>	4
2.2.2	<i>Government Emissions Inventory</i>	5
3	Conclusion	9
	Appendix 1 Data Sources	10
	<i>Town of Bedford Community-Wide Emissions Inventory Source Data for 2004</i>	10
	<i>Town of Bedford Government Operations Emissions Inventory Source Data for 2004</i>	11
	Appendix 2 Inventory Reports.....	12
	<i>Community Emissions in 2004:: Detailed Report</i>	12
	<i>Government Emissions in 2004: Detailed Report</i>	13

1 Introduction

In April 2007, The Town of Bedford joined ICLEI; the Town Board adopted a resolution committing the Town to taking action for climate protection. Through this resolution, the Town recognized the “profound effect” that greenhouse gases emitted by human activity are having on the Earth’s climate, as well as the Town’s opportunity to reduce these emissions, both through its government operations and by inspiring change throughout the community. Through energy efficiency in its facilities and vehicle fleet, alternative clean energy sources, waste reduction efforts, land use and transit planning, and other activities, the Town of Bedford can achieve multiple benefits, including saving energy and money, reducing emissions, and preserving quality of life in our community. With the assistance of ICLEI – Local Governments for Sustainability, the Town has begun its efforts to identify and reduce greenhouse gas emissions.

This document represents completion of the first milestone in ICLEI’s five milestone process: conducting an inventory of greenhouse gas emissions. Presented here are estimates of greenhouse gas emissions resulting from our community as a whole, as well as those resulting from the Town’s internal government operations. Due to data availability, community data and government operations data is based on the year 2004. This data will provide a baseline against which we will be able to compare future performance, enabling us to demonstrate progress in reducing emissions.

1.1 Climate Change Background

A balance of naturally occurring gases dispersed in the atmosphere determines the Earth’s climate by trapping solar heat. This phenomenon is known as the greenhouse effect. Modern human activity, most notably the burning of fossil fuels for transportation and electricity generation, introduces large amounts of carbon dioxide and other gases into the atmosphere. Collectively, these gases intensify the natural greenhouse effect, causing global average surface temperature to rise, which is in turn expected to affect global climate patterns.

Overwhelming evidence suggests that human activities are increasing the concentration of greenhouse gases in the atmosphere, causing a rise in global average surface temperature and consequent climate change. In response to the threat of climate change, communities worldwide are voluntarily reducing greenhouse gas emissions. The Kyoto Protocol, an international effort to coordinate mandated reductions, went into effect in February 2005 with 161 countries participating. The United States is one of three industrialized countries that chose not to sign the Protocol.

In the face of federal inaction, many communities in the United States are taking responsibility for addressing climate change at the local level. Westchester County and the Town of Bedford are likely to be impacted by changes to local and regional weather patterns and species migration. Scientists also expect changing temperatures to result in more frequent and damaging storms accompanied by flooding and land slides, summer water shortages as a result of reduced snow pack, and disruption of ecosystems, habitats and agricultural activities.

1.2 The Communities for Climate Protection Campaign

By adopting a resolution committing the Town to locally advancing climate protection, The Town of Bedford has joined an international movement of local governments. More than 1000 local governments, including over 500 in the United States, have joined ICLEI's Cities for Climate Protection (CCP) campaign.¹ In addition to The Town of Bedford the neighboring towns of Cortland, Croton-on-Hudson, Dobbs Ferry, Greenburgh, Hastings-on-Hudson, Larchmont, Mamaroneck, Mt. Kisco, New Castle, New Rochelle, North Castle, Ossining, Tarrytown, Yonkers, Yorktown and Westchester County are all CCP participants.

The CCP campaign provides a framework for local communities to identify and reduce greenhouse gas emissions, organized along five milestones:

- (1) Conduct an inventory of local greenhouse gas emissions;
- (2) Establish a greenhouse gas emissions reduction target;
- (3) Develop an action plan for achieving the emissions reduction target;
- (4) Implement the action plan; and,
- (5) Monitor and report on progress.

This report represents the completion of the first CCP milestone, and provides a foundation for future work to reduce greenhouse gas emissions in The Town of Bedford.

2 Greenhouse Gas Emissions Inventory

The first step toward reducing greenhouse gas emissions is to identify baseline levels and sources of emissions in The Town of Bedford, as well as the sectors of our community and government operations that are responsible for the bulk of these emissions. This information can later inform the selection of a reduction target and possible reduction measures.

2.1 Methodology and Model

ICLEI's Communities for Climate Protection methodology assists local governments to systematically track energy and waste related activities in the community, and to calculate the relative quantities of greenhouse gases produced by each activity and sector. The inventory methodology involves performing two assessments: a communitywide assessment and a separate inventory of government facilities and activities. The government inventory is a subset of the community inventory.

Once completed, these inventories provide the basis for the creation of an emissions forecast, and allow for the quantification of emissions reductions associated with proposed measures.

¹ ICLEI was formerly known as the International Council for Local Environmental Initiatives, but the name has been changed to ICLEI – Local Governments for Sustainability.

2.1.1 CACP Software

To facilitate community efforts to reduce greenhouse gas emissions, ICLEI developed the Clean Air and Climate Protection (CACP) software package with the State and Territorial Air Pollution Program Administrators (STAPPA), the Association of Local Air Pollution Control Officials (ALAPCO), and Torrie Smith Associates. This software calculates emissions resulting from energy consumption and waste generation. The CACP software determines emissions using specific factors (or coefficients) according to the type of fuel used. Greenhouse gas emissions are aggregated and reported in terms of equivalent carbon dioxide units, or CO₂e. Converting all emissions to equivalent carbon dioxide units allows for the consideration of different greenhouse gases in comparable terms. For example, methane is twenty-one times more powerful than carbon dioxide on a per molecule basis in its capacity to trap heat, so the CACP software converts one ton of methane emissions to 21 tons of carbon dioxide equivalents. The CACP software is also capable of reporting input and output data in several formats, including detailed, aggregate, source-based and time-series reports.

The emissions coefficients and methodology employed by the CACP software are consistent with national and international inventory standards established by the Intergovernmental Panel on Climate Change (1996 Revised IPCC Guidelines for the Preparation of National Inventories) and the U.S. Voluntary Greenhouse Gas Reporting Guidelines (EIA form 1605).

The CACP software has been and continues to be used by over 500 U.S. cities, towns, and counties to reduce their greenhouse gas emissions. However, it is worth noting that, although the software provides The Town of Bedford with a sophisticated and useful tool, calculating emissions from energy use with precision is difficult. The model depends upon numerous assumptions, and it is limited by the quantity and quality of available data. With this in mind, it is useful to think of any specific number generated by the model as an approximation of reality, rather than an exact value.

2.2.2 Creating the Inventory

Our greenhouse gas emissions inventory consists of two essentially distinct inventories: one for the Town of Bedford community as a whole, defined by our geographic borders, and one highlighting emissions resulting from the Town of Bedford's internal government operations. The government inventory is a subset of the community-scale inventory (the two are not mutually exclusive). This allows the government, which formally committed to reducing emissions, to track its individual facilities and vehicles and to evaluate the effectiveness of its emissions reduction efforts at a more detailed level. At the same time, the community-scale analysis provides a performance baseline against which we can demonstrate progress being made throughout the Town of Bedford community.

Creating our emissions inventory required the collection of information from a variety of sources (See Appendix 1 for inventory source data.) Data from the year 2004 was used for both the community inventory and the government inventory.

When calculating the Town of Bedford's emissions inventory, all energy consumed in the Town of Bedford was included. This means that, even though the electricity used by Town of Bedford residents is produced elsewhere, this energy and the emissions associated with it appears in the Town of Bedford's inventory. The decision to calculate emissions in this manner reflects the general philosophy that a community should take full responsibility for the impacts associated with its energy consumption, regardless of whether or not the energy generation occurs within its geographic borders.

2.2 Inventory Results

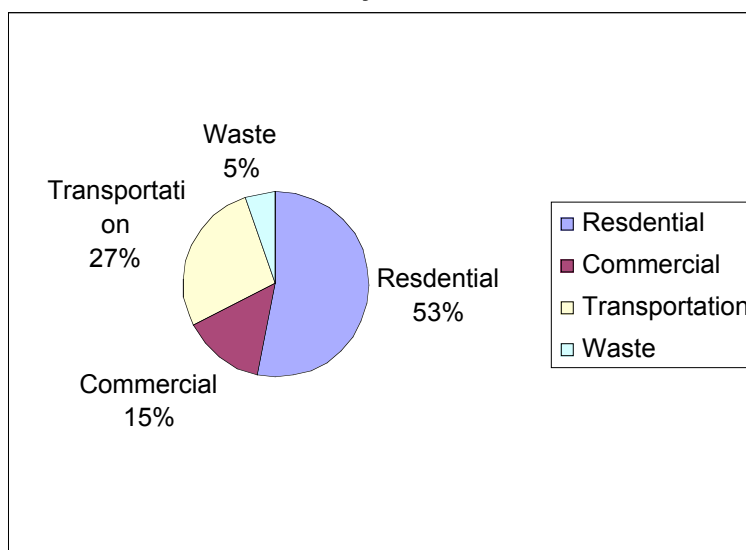
2.2.1 Community Emissions Inventory

In the base year 2004, the community of The Town of Bedford emitted approximately 275,951 tonnes of CO₂e. As shown in Table 1, and illustrated in the pie chart below, Residential use was the greatest contributor to greenhouse gas emissions at 53% of the total. The Commercial sector contributed 15%, Transportation contributed 27%, and Waste contributed 5% of the community's total greenhouse gas output.

Table 1: The Town of Bedford Community-Wide Greenhouse Gas Emissions in 2004

Sector	Greenhouse Gas Emissions (tonnes CO₂e)	Energy Equivalent (MMBtu)
Residential	146,451	1,806,823
Commercial	40,116	400,452
Transportation	74,693	959,118
Waste	14,691	
Total	275,951	3,166,393

Figure 1. The Town of Bedford Community-Wide Greenhouse Gas Emissions in 2004



The Town of Bedford community's consumption of electricity and other fuels in local buildings and vehicles is also responsible for the release of criteria air pollutants, including NO_x, SO_x, CO, VOCs, and PM₁₀. The Transportation sector is responsible for the majority of NO_x, CO and VOC emissions, while energy used in buildings is primarily responsible for emissions of SO_x and PM₁₀.

Table 2. The Town of Bedford Community-Wide Criteria Air Pollutant Emissions in 2004

Sector	NO _x (lbs)	SO _x (lbs)	CO (tonnes)	VOCs (lbs)	PM ₁₀ (lbs)
Residential	472,950	502,916	79	24,440	126,786
Commercial	110,210	305,689	37	9,756	68,026
Transportation	580,583	30,162	1,966	455,526	17,166
Total	1,163,743	838,766	2,082	489,722	211,977

2.2.2 Government Emissions Inventory

In the base year 2004, The Town of Bedford's government operations generated 5,360 tonnes of CO₂e. The Town's buildings were the greatest contributors, emitting 74% of the total. The vehicle fleet contributed 20%, streetlights contributed 5%, and waste contributed 1% of the government emissions.

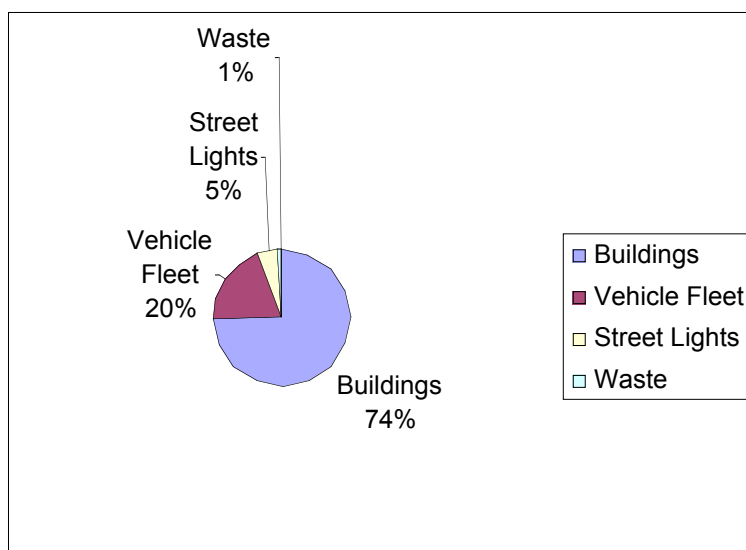
During 2004, the Town of Bedford government spent approximately \$552,923 on energy-related expenses for its buildings, streetlights and vehicles. Beyond reducing harmful greenhouse gases, any future reductions in government operations' energy use have the potential to reduce this expense, enabling the Town of Bedford to reallocate limited funds toward other deserving causes. Table 3 and Figure 2 below illustrate the breakdown of government operations

emissions by source type. (See Appendix 2 for a detailed listing of government operations energy consumption and greenhouse gas emissions by activity.)

Table 3: The Town of Bedford Government Operations Emissions Summary

Sector	Greenhouse Gas Emissions (tonnes CO ₂ e)	Energy Equivalent (million Btu)	Cost (\$)
Buildings	4,000	64,611	229,415
Vehicle Fleet	1,056	13,466	148,436
Streetlights	251	2,118	96,399
Waste	53		78,673
TOTAL	5,360	80,194	552,923

Figure 2. Government Operations Greenhouse Gas Emissions in 2004



Government operations emissions in The Town of Bedford constitute about 2.6 percent of the community's total greenhouse gas emissions. This is not unusual; local government emissions typically account for around two percent of community levels. As a minor contributor to total emissions, actions to reduce government operations energy use will have a limited impact on The Town of Bedford community's overall emissions levels. However, as previously mentioned, government action has symbolic value that extends beyond the magnitude of emissions actually reduced.

Table 4. The Town of Bedford Building Energy Use Greenhouse Gas Emissions in 2004²

Site	Light fuel Oil Use (US Gal)	Light fuel Oil Cost(\$)	Electricity Use (kWh)	Electricity Cost (\$)	Natural Gas Use (therms)	Natural Gas Cost (\$)	Energy Equivalent (MMBtu)	Greenhouse Gas Emissions (tonnes CO ₂ e)
21 Park Ave	1,839	2,312			3,078	3,415	3,397	195
301 Adams	6,841	8,464	55,593	7,794			1,147	94
425 Cherry St			107,340	12,994	2,400	2,735	2,815	181
87 Adams	162	168					1	0
Annex 307, 309 Bedford Rd			26,563	3,329			91	11
BH Community House	4,308	5,525	18,263	3,169	3,402	1,042	4,136	247
Cedar Downs Pump house					34,072	6,061	34,757	1,948
Crusher Rd Garage	2,753	3,300					385	29
Depot Plaza			2,400	488	1,135	1,368	1,166	66
Guard Hill Tower					3,648	836	3,721	209
Haines Rd Soccer Fld			5,540	2,517			19	2
Charles Rd – Hwy					742	298	757	42
Rt 22 – Hwy Garage			16,384	2,281			56	7
Police Station	3,707	4,881	182,340	19,153			1,141	113
Rec – pools/filters/ bathhouse/concession	510 (propane)	704	236,821	28,137			856	99
Tenant Space			9,983	1,380			34	4
321 Bedford Road			183,520	22,087	7,020	7,644	7,788	476
Water Pumps/ Facilities/Tanks			687,108	77,333			2,345	278
Buildings Total	20,120	25,354	1,531,855	180,662	55,497	23,399	64,611	4000

Table 5. The Town of Bedford Street and Traffic Lighting Greenhouse Gas Emissions in 2004

Site	Electricity Use (kWh)	Electricity Cost (\$)	Energy Equivalent (MMBtu)	Greenhouse Gas Emissions (tonnes CO ₂ e)
Traffic Signals	37,945	5,990	130	15
Parking Lots	72,546	11,300	248	29
Flashing Light – Rt 172	1,412	215	5	1
Kat.Bed/BH	472,384	73,326	1,612	191
B.H. Street Lighting	36,162	5,568	123	15
Street & Traffic Total	620,449	96,399	2,118	251

Table 6. The Town of Bedford Vehicle Fleet Greenhouse Gas Emissions in 2004

Department	Gasoline Consumption (gal)	Diesel Consumption (gal)	Total Fuel Cost (\$)	Energy Equivalent (MMBtu)	Greenhouse Gas Emissions (tonnes CO ₂ e)
Police pump	40,564		57,306	5,095	395
Highway Pump	9,145	58,943	91,130	8,371	660
Vehicle Fleet Total	49,709	58,943	148,436	13,466	1,055

The Town of Bedford was also responsible for the release of criteria air pollution in 2004, as shown below. These pollutants have been linked with various environmental and public health outcomes and many of the actions we might take to reduce greenhouse gas emissions will also have a positive impact in reducing these pollutants as well.

Table 7. The Town of Bedford Government Operations Criteria Air Pollutant Emissions in 2004

Sector	NO _x (lbs)	SO _x (lbs)	CO (tonnes)	VOCs (lbs)	PM ₁₀ (lbs)
Buildings	11,542	6,653	2	765	1,654
Streetlights	527	1,630		88	517
Vehicle Fleet	5,534	185	16	4,337	396
Total	17,604	8,467	18	5,190	2,568

3 Conclusion

In passing a resolution to join the Communities for Climate Protection campaign, The Town of Bedford made a formal commitment to reduce its emissions of greenhouse gases. This report lays the groundwork for those efforts by estimating baseline emissions levels against which future progress can be demonstrated.

This analysis found that The Town of Bedford community as a whole was responsible for emitting 275,951 tonnes of CO₂e in the base year 2004, with the residential sector contributing 53 percent, the commercial sector contributing 15 percent, the transportation sector contributing 27 percent and the waste sector contributing 5 percent to this total. The Town of Bedford's government operations were responsible for 5,360 tonnes in 2004. The Town of Bedford's government operations account for roughly 2 percent of the community's total greenhouse gas emissions.

Following the ICLEI methodology, we recommend that The Town of Bedford's next forecast anticipated future emissions and engage in consideration of potential greenhouse gas reduction targets for both the community as a whole, and internal government operations. The Town should also begin to document emissions reduction measures that have already been implemented since the base years documented in this report, and to quantify the emissions benefits of these measures to demonstrate progress made to date.

Next, the Town should begin to identify potential new emissions reduction measures that might be implemented in the future, including energy efficiency, clean energy, vehicle fuel efficiency or alternative fuel use, trip reduction strategies, waste reduction, and other projects. We feel confident that a number of opportunities exist for the Town to reduce emissions while saving taxpayer dollars, improving efficiency and reducing waste.

The Town of Bedford's Energy Advisory Panel will advise and support the Town Supervisor and Town Board in continuing the climate protection efforts of The Town of Bedford. The Panel is eager to aid the Town in its demonstrated leadership on this important issue.

Appendix 1 Data Sources

Community-Wide Emissions Inventory Source Data for 2004

Community-Wide Aggregate Utility Data

	Electricity (kWh)	Natural Gas (therms)	Light Fuel Oil (US Gal)	Energy Equivalent (MMBtu)
Residential	93,424,722	2,284,570	8,999,250	1,806,823
Commercial	45,455,743	790,520	569,620	313,914
Subtotal	138,880,465	3,075,090	9,568,870	2,120,737

Data provided: NYSEG and Con Edison data 2004

Community-Wide Transportation Data

	Vehicle Miles Traveled (millions)	Energy Equivalent (MMBtu)
Subtotal	124.3	959,118

Transportation data from: New York Metropolitan Transportation Council – Michael Chiume (Senior Transportation Analyst)

Community-Wide Waste Data

	Amount of Waste Landfilled (tons)	Waste Composition (%)	Equivalent CO2 (tonnes)
<i>Community Waste</i>	15,239	100	14,691
Paper Products	5,791	38	
Food Waste	1,981	13	
Plant Debris	1,524	10	
Wood/Textiles	610	4	
All Other Waste	5,334	35	
Total Waste Landfilled	15,239	100	14,691

Waste data from: Assumptions based on EAP data on waste generation per person/day

Government Operations Emissions Inventory Source Data for 2004

The Town of Bedford Building Energy Use

	Light Fuel Oil (US Gal)	Light Fuel Oil Cost (\$)	Electricity Use (kWh)	Electricity Cost (\$)	Natural Gas Use (therms)	Natural Gas Cost (\$)
Buildings						
Total	20,120	25,354	1,531,855	180,662	55,497	23,399

Data provided: All municipal data was obtained from 2004 invoices (Feb 2004-Jan 2005) filed in the “paid prior” files in the basement of the Town House, 321 Bedford Road

The Town of Bedford Street and Traffic Lighting

Site	Electricity Use (KWH)	Electricity Cost (\$)
Traffic Signals	37,945	5,990
Parking Lots	72,564	11,300
FlashLight – Rt 172	1,412	215
Kat.Bed/BH	472,384	73,326
B.H. Street Lighting	36,162	5,568
Street/Traffic Total	620,467	96,399

Data provided by: All municipal data was obtained from 2004 invoices (Feb 2004-Jan 2005) filed in the “paid prior” files in the basement of the Town House, 321 Bedford Road

The Town of Bedford Vehicle Fleet

Department	Gasoline Consumption (gal)	Diesel Consumption (gal)	Total Fuel Cost (\$)
Police Pump	40,564		57,306
Highway Pump	9145	58943	91,130
Subtotal Vehicle Fleet	49,709	58,943	148,436

Data provided by: All municipal data was obtained from 2004 invoices (Feb 2004-Jan 2005) filed in the “paid prior” files in the basement of the Town House, 321 Bedford Road

Appendix 2 Inventory Reports

Community Emissions in 2004: Detailed Report

	Equiv CO ₂	Equiv CO ₂	Energy Equivalent
	(tonnes)	(%)	(MMBtu)
Residential			
Town of Bedford Aggregate Residential Energy Use			
<i>Electricity</i>	39,193	14.2	318,856
<i>Light Fuel Oil</i>	94,453	34.2	364,498
<i>Natural Gas</i>	12,805	4.6	228,457
<i>Subtotal Residential</i>	146,451	53.1	911,811
Commercial			
Town of Bedford Aggregate Commercial Energy Use			
<i>Electricity</i>	19,069	10.8	155,139
<i>Industrial Electricity</i>	612	0.	4,980
<i>Municipal Electricity</i>	10,025	0.	81,558
<i>Light Fuel Oil</i>	5,979	2.2	79,722
<i>Natural Gas</i>	4,431	1.6	79,052
<i>Subtotal Commercial</i>	40,116	14.5	400,452
Transportation			
Town of Bedford Community VMT Estimate			
<i>Gasoline</i>	61,860	22.4	796,135
<i>Diesel</i>	12,833	4.7	162,983
<i>Subtotal Transportation</i>	74,693	27.1	959,118
Waste			
Land filled Community Waste			
<i>Paper Products</i>	11,233	4.1	
<i>Food Waste</i>	2,175	0.8	
<i>Plant Debris</i>	948	0.3	
<i>Wood/Textiles</i>	335	0.1	
<i>Subtotal Land filled Community Waste</i>	14,691	5.3	
Total	275,951	100.0	3,166,393

This report has been generated for The Town of Bedford, New York using STAPPA/ALAPCO and ICLEI's Clean Air and Climate Protection Software developed by Torrie Smith Associates Inc.

Government Operations Emissions in 2004: Detailed Report

	Equiv CO₂ (tonnes)	Equiv CO₂ (%)	Energy Equivalent (MMBtu)
Buildings			
<i>Fuel Oil</i>	204	3.8	2,722
<i>Electricity</i>	620	11.6	5,229
<i>Natural Gas/Propane</i>	3176	59.3	56,660
Subtotal Buildings	4,000	74.6	64,611
Vehicle Fleet			
Highway Pump			
<i>Gasoline</i>	89	1.7	1,150
<i>Diesel</i>	571	10.6	7,213
<i>Subtotal DPW</i>	660	12.3	8,371
Police			
<i>Gasoline</i>	395	7.4	5,095
<i>Subtotal Police</i>	395	7.4	5,095
Subtotal Vehicle Fleet	1,055	19.7	13,466
Streetlights			
Traffic Signals			
<i>Electricity</i>	15	.3	130
<i>Subtotal Traffic Signals</i>	15	.3	130
Parking Lots			
<i>Electricity</i>	29	.5	248
<i>Subtotal Parking Lots</i>	29	.5	248
Flashing Light-Rt 172			
<i>Electricity</i>	1	0	5
<i>Subtotal Flashing Light</i>	1	0	5
Kat/Bed/BH			
<i>Electricity</i>	191	3.6	1,612
<i>Subtotal Kat/Bed/BH</i>	191	3.6	1,612
BH Street Lighting			
<i>Electricity</i>	15	.3	123
<i>Subtotal BH Street Lighting</i>	15	.3	123
Subtotal Streetlights	251	4.7	2,118
Waste	53	1.0	
Subtotal Waste	53	1.0	
Total	5,360	100.0	80,194

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